

DEPARTMENT OF AGRICULTURE
DAIRY COMMISSIONER'S BRANCH
OTTAWA, CANADA

A REPORT ON

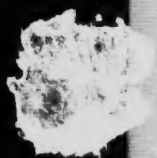
SOME PHASES OF DAIRYING IN DENMARK

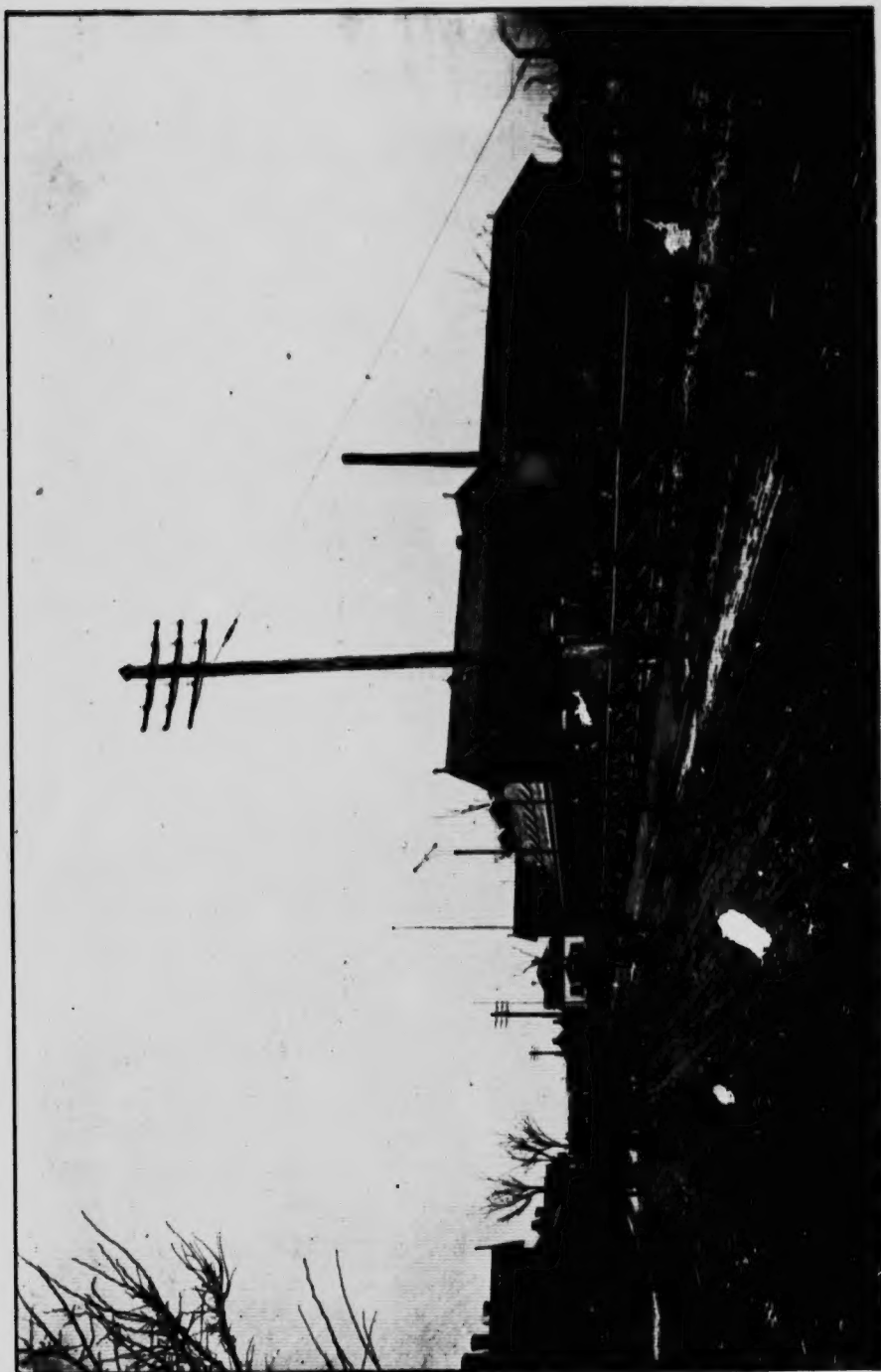
BULLETIN No. 4

Published by direction of the Hon. S. DNEY A. FISHER, Minister of Agriculture, Ottawa, Ont.

MAY, 1905

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'TRIFOLIUM,' THE LARGEST CREAMERY IN DENMARK.

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TO THE HONOURABLE THE MINISTER OF AGRICULTURE.

SIR,—I herewith submit for your approval Bulletin No. 4 of the Dairy Commissioner's Branch series, which consists of a Report on some Phases of Dairying in Denmark, by Mr. C. Marker, one of my assistants.

This report contains information which should be of great interest and value to Canadian dairymen. I beg to recommend that it be printed for general distribution.

I have the honour to be, sir,

Your obedient servant,

J. A. RUDDICK,

Dairy Commissioner.

OTTAWA, May 5, 1905.

INTRODUCTION.

The report which Mr. Marker presents contains many valuable suggestions for Canadian dairymen, and especially for those who are connected with the creamery branch of the dairy industry.

Two strong characteristics of the Danish dairymen are presented in a very favourable light. In the first place there is the splendid loyalty with which these people support all their institutions, whether it be the creamery or any of the various associations which have been organized to promote their interests. The wise and far-seeing policy which they have adopted in these matters makes true co-operation not only possible but highly successful. They are able to see beyond the immediate gain to secure the highest ultimate degree of success and profit-making. In the second place, the thoroughness with which every undertaking is carried out results in great efficiency and a high standard of excellence in all their products.

It is stated that for the three products,—butter, bacon and eggs,—which the Danes send to Great Britain, the extra price which they receive on account of superior quality, *above* the average price for the same products imported into Great Britain from all countries, nets them over eight million dollars a year as their reward for the application of skill and thoroughness.

A glance at Section 1, which deals with the Record Testing Associations, will show that the milk production of the Danish cows far exceeds that of the Canadian herds. It must be remembered that the records given are those of cows belonging to the regular dairy farmers, and are not taken from picked or 'fancy' herds. The figures cover the performances of 14.55 per cent of the total number of milch cows in the country, and may fairly be taken as an average of the productiveness of all the dairy cows. If, as it is claimed, the average yield from Canadian dairy cows is not over 3,000 pounds of milk in a year, what a field is opened up for increasing the profits from dairying in this country. There is no question in the whole range of dairy endeavour which should command more careful attention, not only from milk producers, but from owners of cheese factories and creameries as well, because it is obvious that an increase in the yield of milk from the cows supplying a factory must result in a direct benefit to the manufacturer. The matter does not rest on an increased revenue to the farmer from the production of more milk, but tends towards economy in the converting of the milk into butter or cheese. The managements of all factories are constantly endeavouring to increase their milk supply by widening the area of their operations, to the detriment of some other institution. If the same efforts were directed along the line of encouraging the production of more milk per cow, a more abiding and better general result would be obtained, even from the individual factory standpoint.

If the truth must be told,—and it is better that it should be,—it is these two qualities which have been pointed out as belonging to the Danes in so marked a manner that Canadian dairymen are most lacking in. These pages contain much food

for thought, and many helpful suggestions, which, if acted upon, will certainly prove to be beneficial in more ways than one.

Mr. Marker speaks with authority. He is a Dane himself, knows the language, and got his first training in dairy work before he came to Canada, where he joined the Dominion dairy staff in 1896, after having had charge of the dairy at the Central Experimental Farm for several years. He gathered the information contained in this report during a recent visit to his native land. I am sure what he has written will be read with much interest and profit by everyone who is interested in the dairy industry.

J. A. RUDDICK,

Dairy Commissioner.

REPORT ON SOME PHASES OF DAIRYING IN DENMARK.

By C. MARKER.

To J. A. RUDDICK, Esq.,

Dairy Commissioner, Ottawa.

SIR,—I beg to submit herewith a brief report on some phases of the dairy industry of Denmark.

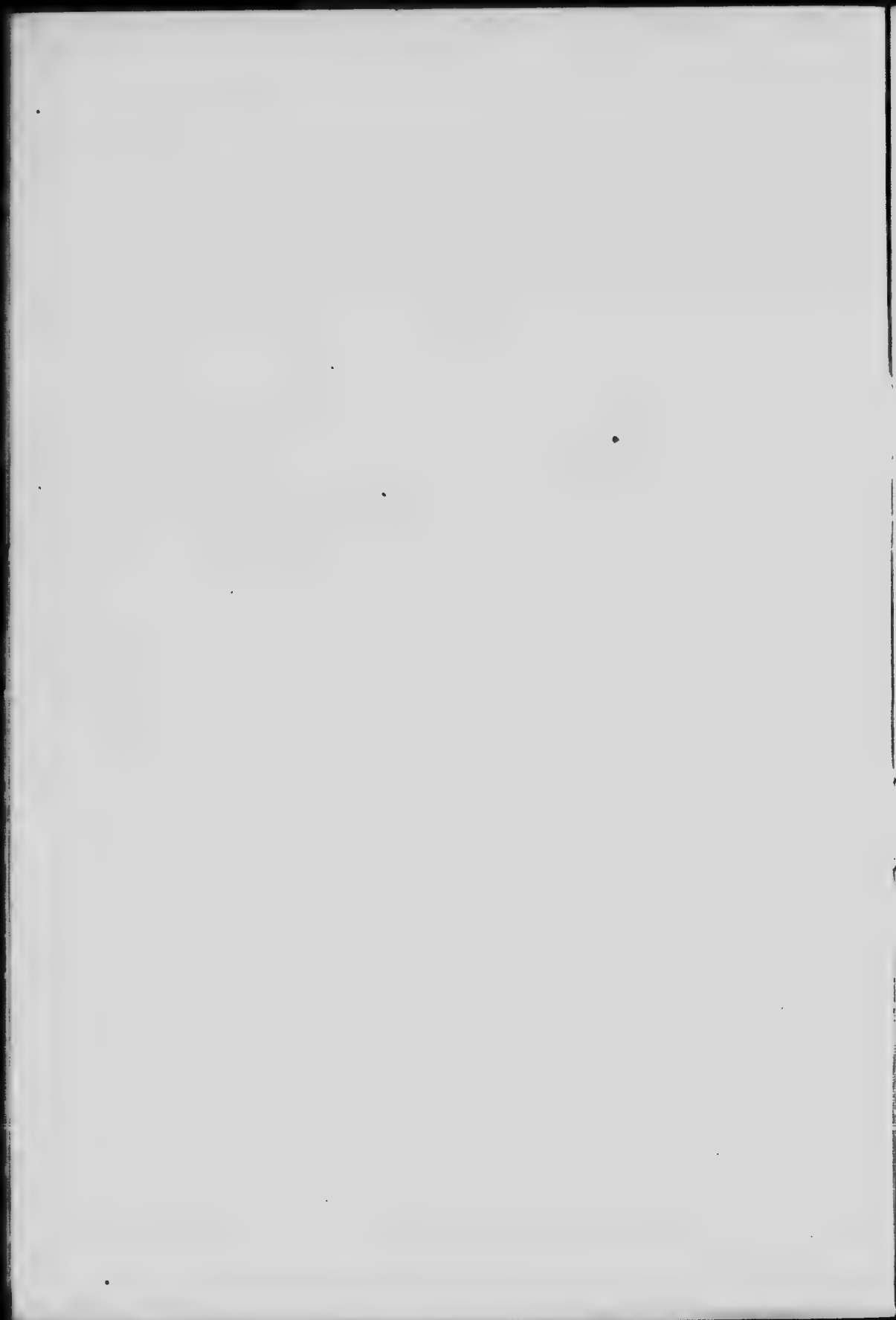
It has been often stated that in regard to dairying we have nothing to learn from the Danes. This statement is no doubt true in some respects, but in others I consider that we have a good deal to learn from them, particularly with respect to co-operation and organization. An admirable spirit pervades the agricultural classes there in regard to matters of this kind. The Danish farmers are justly proud of their co-operative institutions, which are in many respects unique and well worthy of emulation.

The following pages will deal chiefly with the nature, objects and results of some of the co-operative efforts along the line of dairying, which is the principal industry of the country, and which has done so much towards increasing the general prosperity of the nation, of whose total exports agricultural products represent about ninety per cent.

I desire to acknowledge the uniform courtesy received, during my visit to Denmark, at the hands of the officers and experts of the Agricultural Department, college and laboratory. The readiness with which they facilitated my inquiries and placed information at my disposal was fully appreciated.

I am particularly indebted to Mr. M. P. Blem, M.P., president, and one of the foremost workers in the Danish Co-operative Alliance, for statistical and other information freely given at the time of my visit and since.

Respectfully submitted,
C. MARKER.





TYPICAL DANISH CO-OPERATIVE CREAMERY.

I.—RECORD TESTING ASSOCIATIONS IN DENMARK.

GENERAL.

In the year 1895 members of the local Cattle Breeders' Association, Vejen, Denmark, formed themselves into an organization for the purpose of ascertaining, and possibly increasing, the productiveness of their dairy herds, some 800 milch cows.

They found the milk and butter production rather light in comparison with the ruling prices of feedstuffs, and that it did not leave a satisfactory margin of profit on capital invested and labour expended. The farmers realized that, in order to increase the productiveness of their herds, it would be absolutely necessary to ascertain the yield of the individual animals, as well as to learn the quantity and cost of feed consumed by each.

Such work would be costly, and in some cases impracticable, for the individual farmer to carry on single-handed, but on the co-operative plan the cost to the individual would be comparatively slight and quite within reach.

In this way, at a small outlay of money, the relative values of production and feed consumption could be ascertained.

The only accurate and reliable means of obtaining the information sought would be by the use at regular intervals of weigh scales and fat tests, and by a carefully kept record of all details connected with the work.

A set of by-laws being adopted, the association was named the 'Vejen and Vicinity Record (Testing) Association.'

The movement, as might be expected, was watched with a great deal of interest; other districts interested themselves in the matter, and a number of new associations of a similar nature were formed each succeeding year.

The following table shows the rapid increase of associations, membership and cows. According to a recent census, there are in Denmark 1,076,265 milch cows, of which 155,287, or 14.55 per cent, belong to members of record testing associations:—

Year.	Associations.	Members.	Cows.
1895..	2	47	834
1898..	109	1,844	45,005
1902..	327	7,134	130,929
1903..	367	7,990	142,296
1904..	402	8,991	155,287

The by-laws of the Vejen Association are quoted here, because they have been adopted by the majority of the numerous similar organizations which have been formed in other districts from time to time:—

BY-LAWS, VEJEN AND VICINITY RECORD TESTING ASSOCIATION.

1. The object of the association is to develop strains of cows which will produce a large quantity of milk rich in butter-fat.

2. The association to be formed is to continue in operation for a period of five years, and during that time no member can withdraw except by removal from the district.

3. The membership in the association is, for the present, limited to twelve or thirteen, who will agree and undertake to have the milk from the individual cows in their entire herds weighed and tested once every two weeks.

4. The working expense of the association is to be charged to the members in amounts proportionate to the number of samples tested, and such amounts are to be collected semi-annually by the president of the association.

5. The association shall elect a board of management consisting of three members, one of whom shall retire each third year. The retirement shall be by drawing lots the first two years. The board of directors shall elect from among their number a president, who shall also act as manager and treasurer.

6. The board of management shall, on behalf of the association, engage an expert assistant to attend to the sampling and testing of the milk from the individual cows owned by members of the association. The assistant shall also keep a correct and complete account of the milk and butter yield from, and the quantity of food consumed by each cow. He shall also prepare statements showing the comparative results from the different herds and individual animals of each, in order that a selection may be made of the animals which would appear to be specially valuable for breeding purposes.

7. The financial year of this association will be reckoned from May 1st to April 30th, and all the records and statements must be in the hands of the auditor before June 1st following, who will then return them two weeks prior to the annual general meeting of the association.

8. The annual general meeting of the association is to be held not later than the month of July of each year.

9. Any member who desires to present any matter or question for discussion or action at the annual general meeting must communicate same in writing to the president at least eight days prior to the date of meeting.

10. Each member of the association shall have one vote, to be given in person or by lawful proxy.

11. At the annual general meeting not less than one-half of the membership shall be required to form a quorum. Should there be no quorum, a special general meeting may be called for not less than two weeks thereafter, and at such meeting any matter may be dealt with irrespective of the number of members present. At any meeting all questions shall be determined by a majority vote.

12. The association can be dissolved only by a resolution passed at a general meeting.

Adopted January 24th, 1895.

In addition to the foregoing, it may be mentioned that the members of the association pay their assistant a stated salary per year, and furnish him with room and board during his periodical visits, besides conveying him and his equipment to the next farm on his route. The assistant devotes his whole time to the work of the association.

METHOD OF WORKING.

When a record association has been formed an assistant is engaged to carry out the practical details of the work. Being supplied with a complete sampling and milk testing equipment, he makes periodical visits to the farm of each member of the association, the frequency of his visits depending on the number of members.

In the majority of cases each farm is visited once every two weeks, and the day's milk from each cow is carefully weighed, and afterwards sampled and tested by the assistant, who makes the entries in a book kept for the purpose, not only of the milk and butter-fat yield, but also of the quantities of feed consumed by each cow since his last visit. The farmer keeps a record of the latter from day to day as nearly and as accurately as possible. A uniform system of book-keeping has been adopted by nearly all these associations. The results of the day's milkings multiplied by the number of days have elapsed since the previous test are taken as the yield for that period. The details of the feeding, furnished by the farmer, are recorded and computed into the so-called

FEED UNITS

which furnish the basis for comparison of results obtained from individual animals or herds.

The 'feed units' have been established through a series of feeding experiments planned, and directed for a number of years by the late Professor Fjord, for the Danish government. These experiments extend over a period of something like sixteen years.

The feed units or equivalents, so far as the tests have gone, are about as follows:

One lb. oil cake = 1 lb., grain = 10 lbs., mangels, green feed or carrots = 12½ lbs., turnips = 3 to 4 lbs., hay = 5 to 7 lbs., straw = 1-10 day on pasture.

The cost of the commercial feedstuffs, about 1½ cent per lb., is made the basis for calculating the value of feed units.

As to the composition of feeding rations, we find that according to report of the United Testing Associations of the Province of Fyen, for 1902-03, comprising 24,499 cows, each 100 feed units were made up of the following:—

19	per cent oil cake.
14	" grain (different kinds).
17	" roots.
38	" pasture and green feed.
7	" hay.
5	" straw.
100	"

The Vejen Association reports the proportion thus:—

	1900-01 Per cent	1901-02 Per cent	1902-03 Per cent	1903-04 Per cent
Oil cake.	23	27	24	25
Grain and bran.	11	10	7	5
Pasture and green feed.	27	26	30	30
Roots.	26	23	22	23
Hay.	6	7	10	10
Straw.	7	7	7	7
	100	100	100	100

At the end of each year the assistant prepares his report and a statement showing results of the year's work. This report is then in due course laid before the annual general meeting of the association, and afterwards printed for distribution among the members. These reports contain a great many very interesting facts, and give rise to considerable discussion and reflection. They show at a glance the financial standing of the individual animals in each herd, indicating the yield of milk and butter, the increase in live weight and the quantity and cost of feed consumed.

One of the early reports of the pioneer association shows that one cow of a certain herd produced 10,183 lbs. milk containing 382 lbs. of butter, at a cost of \$63, whilst another in the same herd gave 4,098 lbs. milk, yielding 183 lbs. butter, at a total cost of \$50.

Whilst these figures are extremes, they show the usefulness of the testing and record system, and tend to awaken closeness of observation and careful reasoning on the part of the man who is interested.

QUALIFICATIONS OF THE ASSISTANTS.

The nature of the duties required of the assistant demands that he possess a general knowledge of farming operations, and skill in the work which he is engaged to do, viz., milk sampling and testing, computation of feeding rations, and general book-keeping; also ability to give general advice to the members of the association as to their part of the common work.

Some of the leading agricultural schools in Denmark conduct each year special courses for Record Testing Association Assistants, each course extending over periods of one, two and four months each, and including special instruction in the following branches, viz. :—

1. Milking, weighing and sampling of milk in the stable.
2. The use of Dr. Gerber's milk tester.
3. Practice in book-keeping and recording milk and butter yields, feed consumed by the individual animals, and the keeping of herd books as practised in the ordinary associations.
4. Lectures on milking, constitution of milk, &c.
5. Examination in the principles of cattle feeding and anatomy of domestic animals.
6. Instruction in the judging of live stock.

The students enrolling for these courses are expected to have a practical knowledge of the care and feeding of cattle. They are also expected to be thoroughly skilled in milking, able to write a legible hand, calculate correctly, and to possess generally such mature experience and judgment as will enable them to lead and instruct in every important branch of farm work.

STATE AID.

In accordance with the law of May 23, 1902, the sum of 120,000 kroner (\$32,000) is each year set aside by the Danish government for the purpose of rendering financial assistance to the record associations, in portions of not more than 250 kroner (\$66) to any one association having a membership of at least eight with not less than two hundred cows, such associations having for their objects :—

'The investigation and recording of the feeding, as well as the milk and butterfat yield of each cow in the herd, and on the basis of these to make the cattle industry more remunerative, and work towards the development of more productive strains of cattle.'

SOME OF THE RESULTS.

The Record Testing Association which has the longest record in Denmark is the one formed at Vejen in the year 1895, and through the courtesy of its consulting expert I am able to present some very interesting facts gleaned from late reports. The weights given in the following tables have been translated from the Danish, and represent lbs. avoirdupois.

Table I shows the average result of eight years' work of the above association, and indicates a decided improvement, practically from year to year, in the yield of milk and butter. It will be noted that the 'increase in the live weight' of the animals is also included in the table. The association procured a pair of portable cattle scales in 1897 for the purpose of weighing all animals twice each year, and the advantage of this move is obvious.

TABLE I.

YEAR.	YIELD AVERAGE.				YIELD PER 100 FEED UNITS.			
	No. of Herds.	No. of Cows.	Lbs. Milk.	Per Cent Fat.	Lbs. Butter.	Lbs. Milk.	Lbs. Butter.	Lbs. increase live weight.
1895-96.....	13	393	6,988	3.34	362	143	5.22	
1896-97.....	13	393	6,630	3.26	344	143	5.18	
1897-98.....	19	393	6,406	3.37	243	137	5.04	2.3
1898-99.....	22	440	6,676	3.40	256	144	5.25	3.3
1899-1900.....	25	497	6,768	3.39	290	146	5.37	1.7
1900-01.....	25	504	6,503	3.38	249	136	5.12	2.0
1901-02.....	25	498	6,903	3.40	270	145	5.40	1.9
1902-03.....	26	494	7,335	3.42	282	146	5.55	2.4
1903-04.....	24	485	7,388	3.42	285	146	5.56	1.9
Averages of 9 years.....			6,854	3.37	261	143	5.32	2.2

Table II is a record of one of the better herds owned by a member of the association, and indicates for the last five years a gradual increase in milk yield and per cent of butterfat. This has been accomplished by judicious *feeding, weeding and breeding*. A number of parallel cases appear in the report already referred to.

The herd in question consisted, in 1902-03, of fifteen cows, each consuming, on an average, 5,266 feed units. The average production of the cows was 143 lbs. milk, yielding 5'80 lbs. of butter, and 2'9 lbs. gain live weight per 100 feed units.

TABLE II.—Milk and Butterfat Records of one herd extending over eight years, Vejen.

Year.	Lbs. of Milk.	Per cent of Butterfat.
1895-96.....	7,023	3'30
1896-97.....	7,631	3'25
1897-98.....	6,538	3'28
1898-99.....	5,452	3'30
1899-00.....	5,869	3'36
1900-01.....	6,408	3'39
1901-02.....	6,818	3'42
1902-03.....	7,776	3'52

EXTENSION OF THE WORKS TO OTHER LINES.

The information obtained from the keeping of correct and detailed records of the cost of milk production has proved so valuable and interesting that the work of some of the associations has become extended so as to include other departments of farming, such as cattle, hog and poultry raising, and the growing of field crops.

TESTING ASSOCIATIONS, FYEN.

The following table shows the growth of the movement on the Island Fyen (Funen):—

2 associations were formed in..	1897
11 " "	1898
10 " "	1899
7 " "	1900
11 " "	1901
18 " "	1902
11 " "	1903

The membership of each association varies from 9 to 60.

The membership of each association averages 23.

The number of cows per association averages 380.

Total associations in 1903..	70
" membership "	1,589
" number cows "	24,490

In point of milk production 1,172 herds were classed as follows:—

Yield from	2 herds averaging..	3,300— 4,400 lbs. annually
" 21	"	4,400— 5,500 "
" 135	"	5,500— 6,600 "
" 386	"	6,600— 7,700 "
" 438	"	7,700— 8,800 "
" 158	"	8,800— 9,900 "
" 27	"	9,900—11,000 "
" 5	"	Over 11,000 "
1,172		

If we classify the herds under different percentages of fat in milk we reach the conclusion that the milk from

2 herds gave an average test of..	2'01—3'00 per cent
17 " "	3'01—3'10 "
50 " "	3'11—3'20 "
161 " "	3'21—3'30 "
321 " "	3'31—3'40 "
290 " "	3'41—3'50 "
176 " "	3'51—3'60 "
96 " "	3'61—3'70 "
28 " "	3'71—3'80 "
6 " "	3'81—3'90 "
2 " "	3'91—4'00 "
3 " "	Over 4'01 "

1,172

Table III shows the yearly average yield per cow of 1,172 herds for five years. Although an improvement from our toy year is apparent, yet it is not as great as might be expected, owing, no doubt, to the fact that a number of new herds have been added each year, and these give the poorest results as a rule.

We find that in nine cases out of the ten there is a substantial increase in both milk and butter yield, and in seven cases the test of butterfat has improved.

TABLE III.—Yearly average yield per cow of entire herds.—Fyen.

Year.	No. Cows per 365 Days.	Lbs. of Milk.	Per Cent Fat.	Lbs. of Butter.	Feed Units Consumed.	Yield per 100 Feed Units.	
						Lbs. Milk.	Lbs. Butter.
1898-99.....	3,464.2	6,645	3.37	240	4,167	160	6.0
1899-1900.....	5,467.8	6,833	3.36	254	4,087	160	6.3
1900-01.....	9,352.1	6,752	3.37	268	4,223	158	5.8
1901-02.....	11,987.9	7,032	3.36	264	4,404	158	5.9
1902-03.....	17,082.3	7,428	3.41	281	4,791	156	5.9

Table IV shows the classification and yield of various sized herds for the year 1902-03.

TABLE IV.—Average milk and butter yield from herds of different sizes, 1902-03.

Size of Herds.	Herds.	Cows per 365 Days.	Lbs. Milk.	Per Cent Fat.	Lbs. Butter.	Feed Units Consumed.	Yield per 100 Feed Units.	
							Lbs. Milk.	Lbs. Butter.
Up to 15 cows.....	860	8,061.1	7,813	3.44	299	4,901	150	6.1
16 to 30 cows.....	230	4,505.2	7,665	3.39	288	4,886	157	5.9
31 to 70 cows.....	47	2,193.1	6,822	3.39	257	4,600	151	5.7
Over 70 cows.....	26	2,902.9	6,415	3.36	239	4,486	143	5.3

TABLE V.—Contains the first (1898-99), and latest (1902-03), years' result of a five years' record of ten entire associations, all milking cows and heifers included.

Association No.	1898-99.				1902-03.				INCREASE IN YIELD PER COW.		
	Cows in 365 Days.	Lbs. Milk.	Per Cent Fat.	Lbs. Butter.	Cows in 365 Days.	Lbs. Milk.	Per Cent Fat.	Lbs. Butter.	Lbs. Milk.	Per Cent Fat.	Lbs. Butter.
A.....	240.7	7,151	3.37	268	363.3	7,827	3.44	299	676	0.07	31
B.....	244.6	7,011	3.41	285	306.8	8,078	3.45	309	1,067	0.04	44
C.....	333.2	6,996	3.35	280	286.2	7,730	3.45	286	735	0.10	36
D.....	382.6	6,888	3.37	287	314.4	8,043	3.43	307	1,155	0.06	50
E.....	310.3	6,874	3.40	259	323.1	8,185	3.44	314	1,311	0.04	55
F.....	99.1	6,639	3.25	240	319.5	8,666	3.38	303	1,417	0.13	63
G.....	238.3	6,449	3.33	239	183.0	7,955	3.33	294	1,506		55
H.....	409.1	6,387	3.40	249	418.8	6,371	3.35	236	16	0.14	13
I.....	318.5	6,374	3.40	248	255.8	7,768	3.37	290	1,304	0.12	42
J.....	432.0	6,355	3.24	228	414.7	7,440	3.35	276	1,085	0.11	48

The associations in Fyen are well organized, and work hand in hand with the numerous local cattle breeders' associations, and there is no doubt that there, as in others portions of Denmark, the testing and recording movement has a bright future before it, and will be the means of weeding out many unprofitable animals which are to be found on most farms.

It is the aim of the Central Organization of the Cattle Breeders' and Record Testing Associations in the various provinces of Denmark:—

1. To hold meetings with local managers and assistants of each association for general discussion and instruction.
2. To further and encourage the practice of uniform and thorough book-keeping by the associations.
3. To assist in a thorough training of expert assistants.
4. To assist the record testing associations in their endeavours to include other branches of farm work under a system of careful control.
5. To publish the result of the work done by the various associations, in order that they may attain wide publicity and stimulate the interest of all concerned.

II.—CREAMERIES.

GENERAL.

At the present time there are 1,308 creameries in Denmark, 1,157 of which are conducted on the co-operative plan, each patron being a shareholder; 188 creameries are owned and operated by private individuals or firms, and 63 are so-called 'Estate Dairies,' each of the latter handling the milk of one large herd only, from 100 cows upwards.

The estate dairies were the first in the field to export a uniformly fine quality of butter from Denmark to the British market, and to establish that reputation which the Danish creameries have since sustained for their butter, and which they endeavour to maintain by carefully studying and catering to the requirements of British consumers.

The estate dairies have been able to produce a uniform quality of butter, having well under control the feeding and care of their herds, employing the best qualified buttermakers and using the most suitable machinery and equipment.

But by joint efforts, the smaller farmers made it possible, through the establishment and operation of proprietary and co-operative creameries, to produce a quality of butter equal to that made by the estate dairies, and for which equally good prices are obtained. The first co-operative creamery in Denmark was established in the year 1882, and others followed in rapid succession thereafter.

The 1,057 co-operative creameries manufactured during the last three years 150, 162 and 170 million lbs. of butter respectively, and have now a membership of about 150,000 farmers supplying milk from 860,000 cows, or 86 per cent of the total number of milch cows in Denmark.

The business of these organizations is managed by boards of directors, the individual members or patrons assuming individual and joint responsibility, financially.

Each association is governed by by-laws, containing provisions for the election of officers, financial responsibility of members, milk supply, feeding of milch cows, fines, distribution of profits, general meetings, &c.

The members pledge themselves to furnish to the creamery, for a stated number of years, *all the milk produced by their cows*, with the exception of such quantities as may be required in their households, or which may be disposed of to sick or poor people in their immediate neighbourhood who do not milk cows themselves.



FIG. 1.—DISPOSAL OF DRAINAGE.

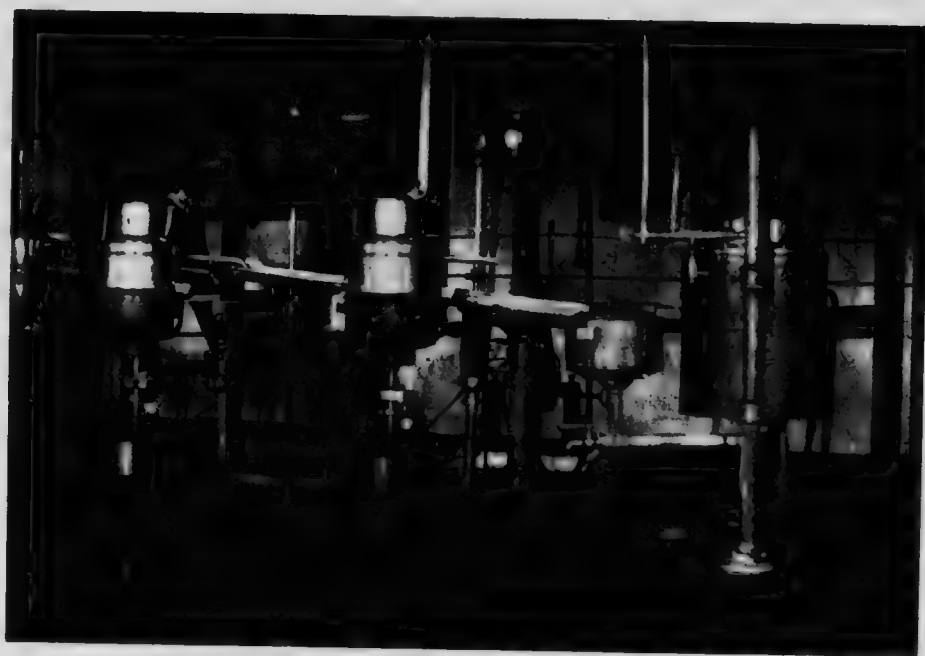


FIG. 2.—SEPARATOR ROOM AT A DANISH CO-OPERATIVE CREAMERY.



CHURNING ROOM AT 'TRIFOLIUM' CREAMERY.

Plate I is made from a photograph of a typical average-size Danish co-operative creamery, which receives and handles seven to eight million pounds of milk annually, and costs in the neighbourhood of \$10,000, fully equipped. Usually, good commodious dwellings for the accommodation and use of the manager, his household and staff of assistants, are erected in close proximity to these creameries. The assistants number from three to five in an average-size creamery, and are employed by the manager. Instead of engaging all the help required in the creamery, the board of directors engage their manager at a stated salary, and he supplies the necessary help, their wages and board.

The managers' salaries are often made up partly of percentages on the business, so he becomes directly and financially interested in the most economical and efficient management of all department of the business.

All the bookkeeping connected with the creameries is done, as a rule, by the managers, many of whom act as treasurers for their associations as well. The young butter-makers, therefore, receive an excellent training in bookkeeping, not only in so far as the patrons' accounts are concerned, but also in connection with the actual practical work done in the creamery each day. A careful record is kept of all milk received and butter and cheese made therefrom, with copious notes on the conditions and temperatures involved in the different process of manufacture. Such extended notes are often valuable for future reference; but the greatest advantage is, I think, that the keeping of detailed records necessitates close and careful observation of the varying conditions under which the butter and cheesemaker has to work from day to day, conditions which might otherwise be considered too trifling for notice.

CREAMERY BUILDINGS.

The creamery buildings are substantial structures built mostly of solid brick, and equipped with the best machinery obtainable. They are all conducted on the whole milk plan. The 'gathered cream' system was introduced at one or two places a few years ago, but the quality of the butter was not satisfactory and the system was abandoned. The original cost of building and equipment varies from \$8 to \$10 per cow capacity. The main building of the creamery shown in Plate I was erected some fifteen years ago, a good evidence of the permanent character of the building. Considerable alteration has been made, however, in the interior to provide for new and enlarged equipment to meet the increased milk supply. The Danish farmers show their confidence in the dairying industry by the permanency of these structures.

FLOORS AND DRAINAGE.

The floors of the creameries are made of cement concrete, or stone flags laid in cement. They are perfectly close, tight and well drained. The drainage is discharged through glazed tile drains, and when convenient used for irrigating purposes.

Figure 1, shows a small valley to the left of the road where several acres are irrigated by the creamery drainage and produce heavy crops of hay or green feed every summer. Some creameries derive a revenue from that source.

If the drainage can not be used in this way it is usually conducted in closed drains to the nearest stream where it can be discharged without becoming a nuisance. I may say that owing to the large quantity of lime used in all Danish creameries for cleansing purposes the drainage is practically without the usual objectionable features, the lime acting as a deodorant.

So far as I can learn there is no law in Denmark regulating the question of drainage except when it becomes a nuisance to the general public or adjacent property holders, and in such cases complaints may be referred to the proper authorities for action.

Septic tanks have been tried, but I understand with negative results. Owing to a very large quantity of water used in the creameries for cooling, in addition to that

used for cleansing purposes, the solid organic matter in the drainage is not sufficient to induce the proper bacterial action in the septic tanks.

SURROUNDINGS.

These, are as a rule, made attractive by the planting of trees and shrubbery, and by well kept grounds around the creamery and dwelling house. The creamery manager knows that in order to make the best impression on the minds of his patrons in the matter of cleanliness and care in milking and in the handling of milk, it is necessary that his creamery, both interior and surroundings, should be a standing object lesson in cleanliness and neatness.

MACHINERY AND APPLIANCES.

Plates II and III show an interior view of the separating and churning rooms of the largest creamery in Denmark, handling 25 to 30 million pounds of milk annually. The churns in general use and shown in Plate III are the so-called 'Holstein' type, but the combined churn and worker is being introduced now and will no doubt supplant the former in course of time, as it is certainly a great labour saving machine in a large creamery.

Figure 2, is a snap-shot taken of a corner in the separating room of one of the 'model' creameries, which I shall refer to later. It shows the arrangement of the weighing platform, whole milk heater, cream separators, skim milk pump and cream pasteurizer, which elevates the heated cream into conductors leading to the coolers. The pump supplies the skim milk pasteurizer. The skim milk is not cooled, however, but weighed into the patron's milk can direct.

It is a pleasure to see the carefully made, well-cared-for machinery in most of the Danish creameries. It takes considerable time and labour, it is true, to keep machinery and piping, valves and fittings, well polished every day, but the moral effect on the patrons, and the workers in the creameries too for that matter, of 'labour well done,' is not lost by any means.

THE USE OF LIME.

At all the creameries visited the barrels containing slacked lime occupied a prominent position. It is mainly through the untiring efforts of Professor Boggild that this excellent cleansing and purifying agent has been so largely adopted, not only by the creameries themselves, but also by the creamery patrons. The creameries which years ago practised the 'steaming' of all churns, cream barrels, and other wooden utensils, regularly in order to keep them sweet and pure, now simply scrub them in hot water and while the surface is still warm apply with a brush a generous coating of thick lime wash which is partly absorbed by the pores of the wood, purifying and making it it bright and firm. The surplus lime is afterwards washed off.

In fact, lime takes the place of washing soda, being much superior for cleansing purposes, and a great deal cheaper as well. Lime removes grease and sour smells from floors and utensils, makes tinware brighter, and the grain of wood firm, bright and close. All articles used in preparing fermentation starters are kept submerged in a barrel of clear lime water when not in use.

Lime has no superior for removing oil or grease from floors if applied in a fairly thick layer and left on for a few hours.

The by-laws of some creamery associations recommend strongly to the patrons to use lime instead of soda for cleansing their milk vessels, as well as for whitewashing stables, milk houses, &c.

THE PASTEURIZING AND RIPENING OF CREAM.

Pasteurization is now practised in all Danish creameries, being compulsory according to law. All milk which is used for feeding domestic animals, and all cream

from which butter is made for export, must be heated to a temperature of at least 80 degrees C. or 176 degrees Fahr. This measure was passed by the legislative authorities in Denmark for the purpose of preventing the spread of bovine tuberculosis through the medium of dairy products.

Inspectors and police authorities are appointed to see that this provision is being strictly adhered to by all creameries, and they are authorized to take samples of milk or cream for testing at any time or any place. Not less than 1,256 Danish creameries are now subject to state inspection and control in this respect, and out of 11,805 samples of pasteurized milk and cream submitted to the 'Storch' test last year, 96 to 97 per cent were found to have been heated to, or above, the temperature required by law.

As a matter of fact the very large majority of the creameries employ higher temperatures for the cream than required by law, because an increased temperature results in a finer quality of butter. I found, for instance, at one of the large provincial dairy shows, which I had the privilege of attending, that 90 per cent of the 538 exhibits of creamery butter had been made from cream pasteurized at temperatures ranging from 165 degrees to 194 degrees, and only two packages of that total were characterized by the judges as having 'cooked' flavour.

The butter made from cream heated to such a high temperature has a slightly 'cooked' flavour at first, but this disappears in the course of a few days, provided the cream has been immediately and thoroughly cooled after passing through the pasteurizer.

Comparative experiments have been made by the staff of the Experimental Laboratory at Copenhagen, to ascertain the effect of different pasteurizing temperatures,—167, 176, 185 and 194 degrees Fahr.,—on the quality of the butter, and the results were invariably found to be in favour of the higher temperatures. The experiments were made under ordinary conditions in different creameries, and the conclusions drawn from the tests were:—

1. That butter made from cream pasteurized at the higher temperatures has, on the average, a better immediate as well as keeping quality than that originating from the lower temperature.

2. In order, however, that the higher temperatures can be successfully employed, it is absolutely essential that the cream flowing from the pasteurizer be immediately and thoroughly cooled to the lowest possible temperature,—50 degrees F. or lower.

The pasteurizers used are of the 'Fjord' type, principally parabolic or cylindrical in shape, and elevate the cream to the level of the top of the cooler, which is of the open circular variety, with sufficiently large cooling surface to reduce the temperature of the pasteurized cream to within a couple of degrees of the temperature of the cooling water. Where possible, the cooler is placed near an open window or where pure fresh air from the outside can circulate freely.

It is, of course, essential that the air in the creamery also be pure, and this calls for ventilation and strict cleanliness throughout.

The pasteurizer has been a great educational factor in the creameries for the butter-makers as well as for the creamery patrons. It requires, for instance, that all milk be delivered sweet at the creamery; otherwise pasteurization cannot be carried on successfully. Tainted (acid) milk, or cream, can not be pasteurized without more or less curdling, causing the deposit of a crust on the heating surface of the pasteurizer, and accordingly decreasing its working capacity. (This remark does not apply, of course, to properly ripened and coagulated cream, which can be pasteurized without any difficulty).

When the cream is pasteurized and a pure culture starter is used for its ripening afterwards, much depends on the quality of the latter, it being practically the determining factor of the flavour of the butter made from this cream. Hence the buttermaker must exercise the greatest care and good judgment in the selection and propagation of the fermentation starter.

Pasteurization of cream has been the means of improving and equalizing the quality of the Danish creamery butter, but it makes greater demands also on the skill,

judgment and general ability of the buttermaker, and on the care of the milk on the farms.

It is claimed for the system that it provides an absolute guarantee that Danish butter, made for export, does not contain any germ of tuberculosis or other disease.

FERMENTATION STARTERS AND RIPENING OF CREAM

As already stated, all cream is pasteurized in the creamery, and it follows that fermentation starters have to be used for it. There are now a number of firms who supply creameries with 'pure cultures' at regular intervals, although some buttermakers have been able to keep a culture pure in flavour from one propagation to another for years, by exercising care and scrupulous cleanliness.

Skimmed milk is usually used for developing the culture, and in most cases the buttermaker knows of one or more of his patrons who regularly supply good, clean, pure-flavoured milk. Accordingly, he arranges to have this brought to the creamery early in the day, so that it may be run through the cream separator first. He is then able to get sufficient skim milk for his starter without running chances of having mixed with it milk which may not be quite so good in flavour.

This selected milk is then heated in a water bath to a temperature of 190 to 195 degrees Fahr., and kept at that temperature for a couple of hours, cooled to about 85 degrees, and a small percentage of 'mother' culture added, under thorough stirring. The vessel containing the starter is kept in a warm place, or insulated sufficiently to maintain the temperature as evenly as possible till the milk is ripe, i.e., showing 0.5 per cent of lactic acid. A couple of inches is then skimmed off the surface, the remainder thoroughly stirred, and the starter is ready to be added to the day's cream at the rate of 5 per cent. The cream is ripened at 62 to 65 degrees Fahr. It may be mentioned here that the 'starter' is not stirred during the process of ripening.

According to the record of some 525 creameries, the great majority of the buttermakers allowed their cream to stand from two to four hours from the time the proper point of acidity was reached till churning commenced, at temperatures ranging from 53 to 58 degrees Fahr. This is done to allow the development of that 'nutty' milk flavour and aroma which the consumers of Danish creamery butter appreciate so highly. Besides, cream held at a fairly low temperature for a couple of hours previous to churning produces butter of a firmer texture than cream churned immediately after being cooled to the churning temperature.

SALTING AND WORKING OF BUTTER.

The butter is salted on the butter-worker and left for a period of from one to four hours before it receives the final working. During this time it is kept in boxes, in which the temperature is kept sufficiently low by cold running water, to allow it to become sufficiently firm for re-working and packing. This lapse of time also allows the salt to dissolve thoroughly. In some creameries the butter receives two separate workings between salting and packing.

SHIPMENTS OF BUTTER.

The Danish state railways provide refrigerator cars during the warm season for the transportation of butter and other perishable products to the seaboard, and from thence the butter is carried in cold storage on the steamers to the British ports. The Danish government gives a bonus each year to the steamship company providing mechanical cold storage in its vessels for this purpose.

TESTING COMMITTEES AT CREAMERIES.

I noticed one feature at some of the creameries which might perhaps be adopted in this country with advantage, namely, the so-called 'testing committee,' consisting

of two patrons who were required to be present at the creamery once a week to assist in the sampling and the testing of the milk, furnished by each patron. One member of this committee is appointed by the patrons at the annual meeting of the creamery, to serve for a year at a time, and the other is appointed each week by the creamery manager by the giving of one day's notice to the effect that he is required to be present at the testing of the milk on the following day. Each patron is liable for this service when called upon, but as this duty is taken in turn by all the patrons it simply means about once a year for each of the patrons.

The advantages of this plan are obvious. The patrons have an opportunity of familiarizing themselves with the sampling and testing of milk at the creamery as well as with the grading of the milk at the receiving platform, and to some extent with the work generally.

It also tends to inspire more confidence among the patrons when they know that the work is subject to the check of the testing committee. It is very seldom, therefore, that one hears any complaints on the score of unfair tests against the creamery management.

MILK GRADING AT CREAMERIES.

Although the buttermaker is expected to, and does when time permits, examine the milk brought in from the patrons each day, yet it is felt that he could be considerably strengthened in his decisions regarding the quality and purity of the milk, by the assistance of one thoroughly qualified person engaged expressly for the purpose. In one or two counties the local creameries' associations have formed themselves into organizations to employ permanent milk grading experts, who are to act, in turn, with the local managers of the several creameries within the organizations in the grading and scoring of the milk, and to make this the basis, to some extent, in the distribution of the dividends at the end of each year's business.

The experts visit each creamery in turn, at irregular intervals, and it is reported that considerable improvement is being noticed in the average quality of the milk, particularly with the inferior lots. The milk grader and creamery manager work separately in the examination of the milk, the contents of each can being scored. After this is completed the scores are compared and the average is adopted as the final 'character' of the milk from the time of last examination. To show the utility of this work, I may quote briefly what a well known Danish authority on dairying said at a large public meeting, which I had the privilege of attending last winter:—

'In one of the creameries, where the grading of milk is practised, the annual meeting passed a resolution to the effect that the patrons who did not, after repeated notice, furnish a better quality of milk, should submit to a reduction of 20 to 30 per cent of the value of the milk.

Although the buttermaker is expected to, and does when time permits, examine measure to enforce, yet on second thought that is not at all the case. We will suppose for a moment that no creameries were in existence and that each farmer, as a consequence, would be obliged to manufacture his own butter; the consequence would certainly be that they would either have to give more care and attention to the quality of the product or be satisfied with a lower price than the choice article would bring.'

Instructors are also employed by creamery associations to conduct courses of instruction in milking in different localities, and in the care of milk on the farm, besides assisting, from time to time, in the grading of milk at creameries.

III.—THE DANISH BUTTERMAKERS' ASSOCIATION.

This organization is of a national character and was started nearly 18 years ago. It has for its object the promotion and general development of the dairying industry in Denmark, but it aims more particularly at the mutual improvement, instruction and union of its members.

The association controls the publication of a weekly paper, which is its official organ, devoted to the general discussion of all dairy topics which are deemed to be of interest and importance to the buttermakers and creamery patrons. The paper is ably edited and contains every week interesting and instructive reading matter, reports of markets, experimental work, dairy shows, &c., &c. All members of the Buttermakers' Association receive the official organ free of charge, and are thus kept in touch with one another and with the most recent research work and developments in the broad field of dairying.

The Buttermakers' Association also carries an accident insurance for the benefit of its members, who now number in the neighbourhood of 1,000. The association is divided into local or county branches with a membership varying from 12 to 141 each. The county organizations are self-governing under a common constitution and conduct from 4 to 12 local butter and cheese shows each annually.

The executive of the Danish Buttermakers' Association acts as an advisory body in the administration of certain government grants made annually towards:—(1) Butter and cheese shows, and (2) assistance to buttermakers desiring to attend dairy school courses, or visiting 'model' creameries.

IV.—CO-OPERATIVE CREAMERIES ASSOCIATION.

In order to supplement the work of the buttermakers' organization, which is of a more or less technical nature, many of the co-operative creameries have formed themselves into provincial and national organizations, the latter being the recipients and administrators of the government grants which are made annually towards:—

1. Bureau for creamery statistics.
2. Instruction in milking.
3. Local and provincial butter and cheese shows.
4. Office of engineering expert and assistant.

That the individual creameries appreciate the value of the work done by the association is evident from the fact that some 700 hold membership.

The county branches collect and forward material, i.e., records for the statistical bureau, referred to elsewhere, and in conjunction with the Buttermakers' Association conduct from 6 to 12 dairy shows each during the calendar year.

They also make arrangements for, and conduct, public meetings for creamery patrons and others, engaging as speakers the best men available. The topics for discussion usually relate to the production and care of milk on the farms, thorough milking, farm sanitation, principles of co-operation and kindred subjects.

The subject of milking has been, and is, receiving a great deal of attention at the hands of the Creameries Association.

A few years ago Dr. J. J. Hegelund, a veterinary surgeon, called attention to the fact through the press and from the platform that the Danish farmers were losing large sums of money each year through careless methods of milking their cows, and demonstrated by actual test that he could secure not only a greater quantity, but also a better

quality of milk, i.e., richer in fat, by certain manipulations of the cow's udders prior to and during the act of milking.

The Creameries' Association secured his services for a term of years, his duties to consist in conducting six-day courses in milking at one of the agricultural schools, delivering public lectures and preparing articles for the press on the principles and practice of milking, care of milk on the farms, sanitation and health of domestic animals, improvement of stables, &c.

During the year 1902-3, Dr. Hegelund conducted seventeen courses in milking, delivering also a number of lectures, each course having an attendance of twenty-four, and among the total number not less than sixty-nine visitors from foreign countries.

The writer had the privilege of attending one of Dr. Hegelund's lessons at the Ladelund School, and was impressed with the fact that the pupils were all made to realize that the work they were engaged in was very important and worth doing well.

Cleanliness was, of course, observed throughout, the stables were bright and well ventilated, and the cows well groomed. Each milker was supplied with a damp towel for brushing the udders of the cows to be milked, and several wash basins were placed at convenient points in the stable and used by the milkers.

Dr. Hegelund said that the work he was endeavouring to teach the young people attending his courses on instruction could be summed up in a few words, viz.: The stables should be kept clean, bright and well ventilated, the cows should be made comfortable, be well groomed and cared for. The milking should be done with clean, dry hands and the milkers should treat the cows kindly and take pride in doing their work well. Cleanliness throughout, from the cow to the creamery is imperative.

One of Dr. Hegelund's former pupils writes that he has conducted fifty courses in the new method of milking, on farms throughout the province, and that the total attendance at these classes was 885 men and women.

This work is proceeding hand in hand with that of the Record Testing Associations, helping to increase the productive capacity of the dairy cow, through proper care, feeding and milking.

The Creameries' Association also promotes the work of milk grading and classification at creameries, in fact their field for usefulness is yearly extending. It aims at doing for the creamery patrons what the Buttermakers' Association is doing for its members, i.e., disseminating information and encouraging good work.

V.— BUREAU FOR CREAMERY STATISTICS.

This institution was established in 1898 by the united efforts, and under the auspices, of the co-operative Danish Creamery Associations, the Agricultural Associations and Danish Creamery Buttermakers' Association, for the purpose of collecting material for, and publishing annually, statistics from all the creameries whose management desire to maintain a thorough system of bookkeeping and economical management, for mutual advantage.

The committee which has this work in hand consists of representatives appointed by the various organizations mentioned above, and Mr. Dall, one of the leading dairy experts employed by the state, is the chief of the Bureau.

The statistical work is gaining ground and importance every year, and receives a government grant annually amounting to 9,000 kroner (\$2,430), for the maintenance of the Bureau, which not only collects and publishes statistical information relating to the operation of the creameries, but also the butter prices realized by each every week, the latter being published in the public press weekly. Although the official Danish quotation committee determined and published the nominal quotation in the past with little regard to prices actually received by the creameries, the Statistical Bureau pub-

lished the prices actually received, and this is now made the basis, to a large extent, of the committee's official quotations.

According to these statistics the quality of the milk (in point of fat content), is increasing slightly year by year, no doubt due in a large measure to the work of the Record Association referred to elsewhere; the quantity of milk per cow is also increasing while the manufacturing expenses at the creameries are being reduced gradually.

A notable fact in connection with the reports published by the Bureau is that nearly all the creameries which have furnished their records for a few years have shown a yearly reduction in their expenses for fuel, an item amounting to nearly $\frac{1}{2}$ of a cent per pound of butter manufactured. A mechanical and engineering expert is employed to advise creameries in the matter of installation and economical operation of steam boilers and engines, and it is largely due to his efforts that a number of the creameries have been able to effect a reduction in the expenses for fuel, or rather a more economical use of fuel.

The forms to be filled out by creameries who submit their records to the Bureau for Creamery Statistics show among other items the amount paid out for milk transportation, cartage of coal, butter, &c., salaries of the creamery managers, amounts paid for fuel, ice, butter packages, lubricants, salt and colour, rennet, &c., maintenance of buildings, maintenance and renewal of milk waggons, cleaning material, office and postage, interest on capital, and other expenses.

The report of the Statistical Bureau is a volume of some 150 pages and replete with information; each creamery furnishing statistical material receives a copy, and the management has an excellent opportunity of comparing the 'performance' of the creamery under their charge with that of others differently situated. The detailed information given shows plainly where the greatest care should be focussed with a view to making the business even more profitable, by the reduction of manufacturing expenses. It also stimulates the desire to keep a careful and correct record over details, of which there are so many.

Judging by the number of creameries joining this movement from year to year, one cannot but be impressed with the fact that this work has a future before it, and will play an important part in making dairying even more profitable than at present.

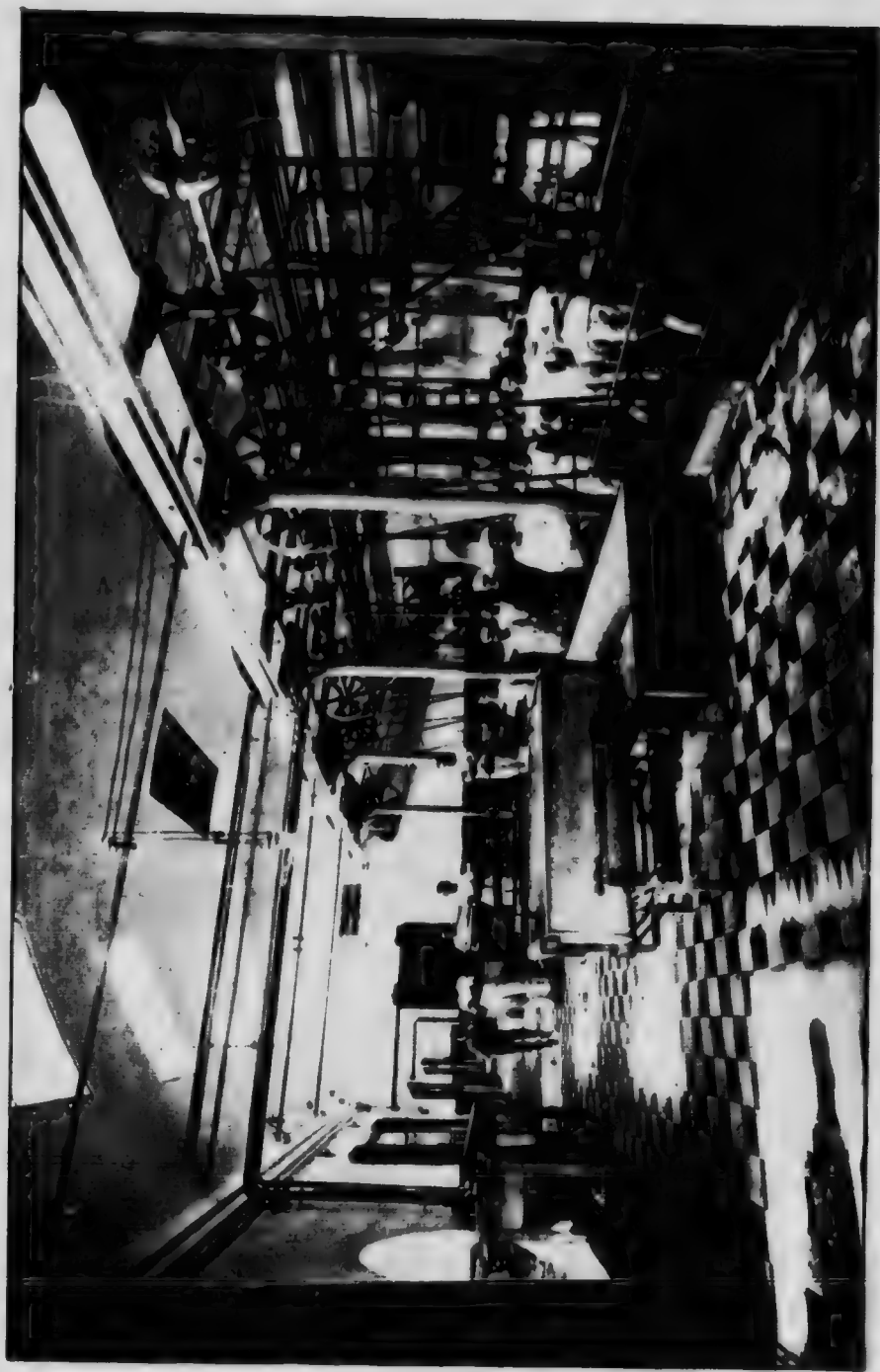
DANISH BUREAU FOR CREAMERY STATISTICS.

Six Annual Reports.

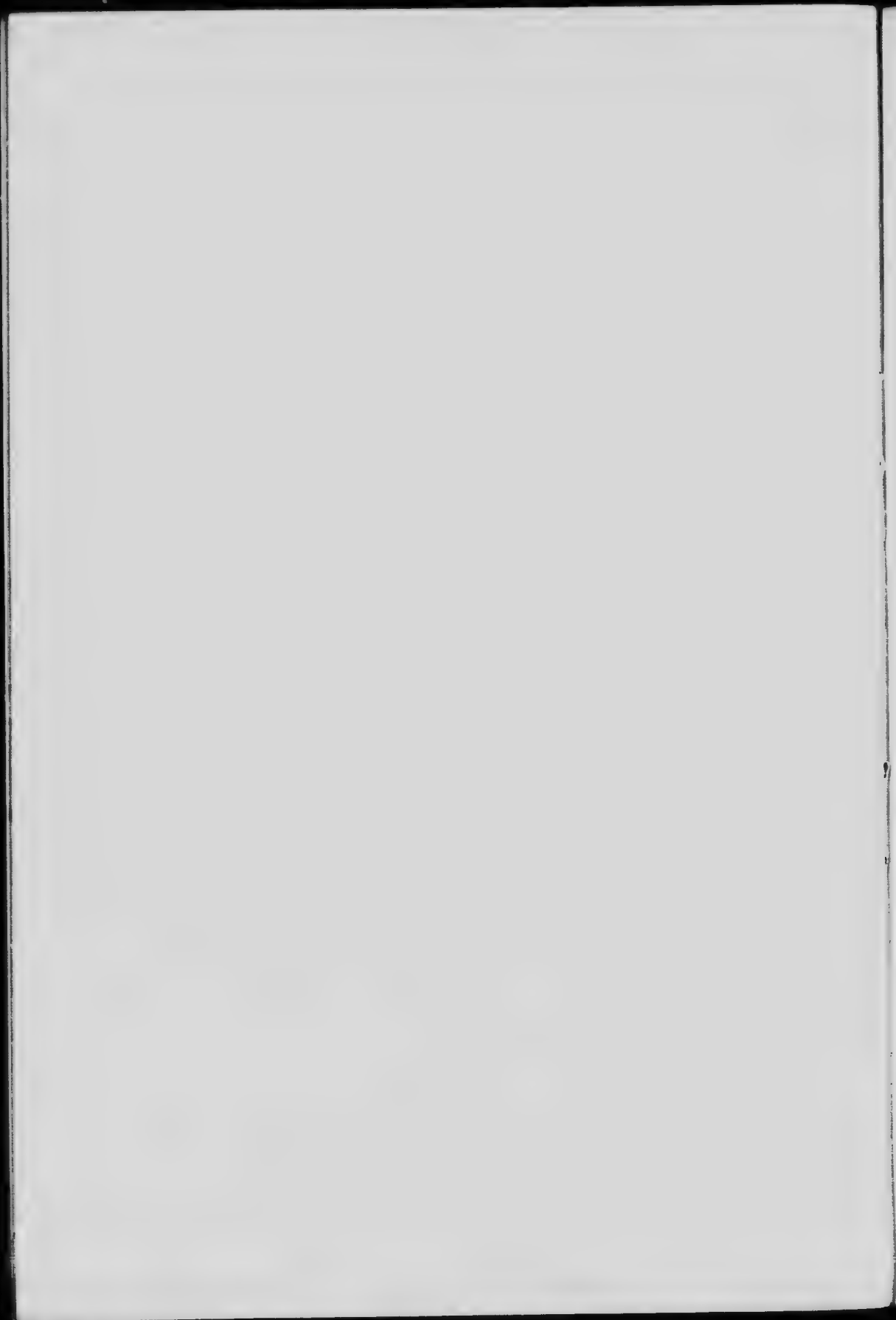
Year.	No. of creameries included in record.	Average lbs. milk per cow.	Pounds milk per pound of butter.
1898..	304	4.490	26.5
1899..	323	4.755	26.4
1900..	323	4.760	26.3
1901..	355	4.842	26.1
1902..	410	5.146	25.9
1903..	483	5.351	25.6

The above table indicates the progress year by year; the figures in column three represent the average quantity of milk received at the creameries per cow. Considering that a good deal of milk is used on the farms for young stock and household, the actual average yield from the cows milked will be of course greater than shown.

As might be expected, the manufacturing expenses are higher, proportionately, in small and medium sized creameries than in the large ones. The average of 1,169 annual creamery records, extending over a period of four years, indicates that the relative cost of manufacturing one pound of butter in creameries handling (1) 12,000 lbs. milk daily, and over, (2) from 6,000 to 12,000 lbs., and (3) under 6,000 lbs. daily was 100, 117 and 141.



MILK RECEIVING AND SEPARATING ROOM AT 'TRIUMPH' CREAMERY.



VI.—THE DANISH BUTTER BRAND ASSOCIATION.

This association was organized in 1900 by 'The Co-operative Creameries' Association,' for the purpose of adopting a common trade brand, to be registered in Denmark and Great Britain for Danish creamery butter. The principal object of this national brand is to afford a guarantee to the consumers of its origin and to prevent the sale of butter manufactured in other countries as 'Danish.'

The brand, known as the 'Lur Brand,' (Fig. 3), is printed on one stave of each butter package together with an individual number, the latter for purposes of identification, and is used by members of the association on all packages containing export butter, as well as for printing on all parchment paper liners, and wrappers, used in this connection.



The Butter Brand Association is divided into twenty local or county branch organizations, the members, i.e. the creameries, of each branch electing a representative to the general board of management to serve for three years at a time; and it is the duty of the representatives to supervise the use of the trade brand within each district. The individual members of the association are held responsible for the safe keeping and proper use of all stamps, impressions, &c., of the registered trade brand. The membership of the association was, on the first of June last, 1,256 creameries, or about 95 per cent of the total number of creameries in Denmark. This satisfactory condition is due to the great work and agitating done by the representatives of the organization, the butter exporters and the public press, in convincing creameries that it is to their advantage to join the movement.

Upon joining this association the creameries pay a nominal fee, equivalent to about \$1.50 each. The working expenses are paid by the members in proportion to the quantity of butter manufactured and exported by each. Efforts are now being made to have legislation passed making the use of the 'Lur Brand' compulsory for all Danish butter whether made for export or for local consumption, and also that all butter imported from other countries, whether for reshipment or local consumption, must be branded in such a manner as to prove its origin and prevent, directly or indirectly, its sale as Danish produce.

These representatives of the creameries belonging to the association elect, every two years, an executive committee consisting of five members, one of whom is elected to serve as president.

The association controls the output of branded staves for the butter packages, the printing of the parchment paper, and the manufacture of stamps and impressions connected therewith; and the creameries holding membership in the association must procure all these supplies from authorized sources or submit to heavy fines. The aim of the Danish Butter Brand Association is to afford a guarantee to the consumers in Great Britain that:—(1) all butter packages bearing the 'Lur Brand,' and these only, contain Danish butter made from cream pasteurized at sufficiently high temperatures to destroy all disease germs, and (2) to establish in an equally clear manner that any butter that does not bear the 'Lur Brand' is not of Danish origin.

VII.—BUTTER EXPORT ASSOCIATIONS.

Although the great bulk of the butter trade in Denmark is handled by butter exporters, many creameries in recent years have formed themselves into butter export

associations, doing business direct with buyers in Great Britain. They find that a slightly higher price can be obtained, and it becomes possible to handle the business on the only sound basis—that of quality. The creameries supplying the best butter get the highest price.

There are some half-dozen of these associations, including nearly two hundred creameries, and the *modus operandi* is usually that each organization is self-governed, the business being handled by a qualified managing director and a salesman, appointed by the representatives of the various creameries holding membership.

The butter is shipped weekly from the creameries to the central storage station of the association. Three packages of butter are picked out promiscuously from each creamery's shipment. The packages, being opened, are covered by a hood so as to conceal their identity, and then scored by two creamery managers and the salesman of the association.

The managers of all the creameries in the organization officiate as judges in turn.

This method of scoring the butter is considered an absolute guarantee of impartiality and gives the individual creamery men an excellent opportunity to see and judge their own butter in comparison with that from other creameries, and in acting on the information and experience thus gained they may be able to effect a great improvement in the quality of their butter, and consequently realize the highest price for it.

VIII.—DAIRY EXHIBITIONS.

LOCAL OR COUNTY EXHIBITIONS.

These are conducted under the joint auspices of the county branches of the Danish Creamery Buttermakers' Association and the Co-operative Creameries' Associations, assisted financially by a government grant of 4,000 kroner (\$1,080) annually, which covers in the neighbourhood of 15 per cent of the actual expenses incurred, the balance being made up *pro rata* by the creameries participating.

These local shows are very useful to the creamery men who take part in them—over 900 in number—and for whose benefit they were especially designed as a means of instruction. The great majority of the exhibitors are able to attend all shows of this kind and have the privilege of examining for themselves any or all of the butter shown, after the judges have completed their labours and placed the awards. Public lectures are also delivered by the principle judges, giving a critical review of the quality of the butter exhibited and suggestions as to remedying the defects pointed out on the score cards.

The value of this association, comparative examination and consultation is obvious. The buttermakers must learn to recognize defects before they can hope to find a remedy and apply it in their daily work. The exchange of ideas and experience is considered to be of paramount importance. Some 150 local butter shows were held last year, and of these 105 were held in the province of Jutland alone, at which 4,613 individual packages of butter were critically examined and scored by the judging committees.

As a test for keeping quality, the butter at the different shows was from 10 to 21 days' old at the time of scoring, and during the intervening time held at temperatures varying from 45 to 54 degrees Fahr.

Following are some of the regulations governing the local or county butter shows:

'Each county branch of the Buttermakers' Association must hold not less than 6 (some hold 8 or more) shows in each calendar year, and the butter must be at least ten days' old at time of judging.

'The butter must be shipped from the creameries not later than the day following the receipt of shipping advice, which must accompany the shipment (placed under the cover of the package wrapped in parchment paper).

'The shipping orders are mailed so as to reach all creameries in the district on the same date, and no previous information is given to any exhibitor as to the date on which the orders will be issued.

'All the butter on exhibition is judged by not less than two, or more than three, groups of judges, who work independently of each other. One group includes, if possible, a butter exporter and the other a consulting dairy expert. Otherwise the groups are usually made up of expert buttermakers.

'The score of the butter is expressed on a scale of from 0 to 15 points. Any defects found in the quality of exhibits are to be fully noted on the score card.

'The butter packages, prior to and during the judging, are to be covered in such a way as to conceal their identity.

'All participating creameries are notified, officially, of the results of the scoring after each show.

'No creamery is allowed to participate in these butter shows outside of its own district.

'Creameries not holding membership in any of the organizations under whose auspices the shows are held, but who wish to participate, are required to pay a special fee for doing so.

'The exhibitors are required to defray all expenses in connection with shipping the exhibits both ways.'

The local butter shows are now recognized as being an established feature of the Danish creamery system, and as such form the basis of the two large provincial exhibitions held annually in each province.

The creameries, or buttermakers, whose average scores have been among the 'best third' of the total during each year at the local shows, receive diplomas provided they have had an average score of 10 points or over. Besides, special prizes are awarded the buttermakers whose butter receives the highest number of points.

Those only who participate regularly in the local shows are privileged to send exhibits to the Provincial Dairy Shows.

PROVINCIAL DAIRY EXHIBITIONS.

These are sometimes dubbed 'Parade Shows' as the exhibitors receive notice long before the butter is to be sent forward, and have, therefore, ample time and opportunity to select the material from which to make their 'show' butter or cheese.

Notwithstanding this criticism the provincial shows have great value. They give the exhibitors an opportunity of showing their product to the very best advantage, and the privilege given to all visitors at the shows to personally examine any or all of the exhibits for themselves, and compare notes after the judging is completed, permits them to gather much information. Besides, the publicity given to these shows helps to awaken and stimulate an interest in dairying throughout the country on the part of the farmers, and this is, perhaps, the most valuable feature.

I had an opportunity to attend a large provincial dairy show in Jutland, at which some 538 packages of butter and 164 cheese were exhibited. The butter was scored by three, and the cheese by two groups of expert judges, each composed of three, and two members respectively.

The judging was done on the day before the exhibition was opened to the public, so as to give the management an opportunity of having all the scores printed in the official catalogue, which contained also full particulars of the manufacture of each exhibit from information furnished by the exhibitors, on a form supplied for the purpose.

According to the catalogue of the exhibits which I viewed I find that all the butter on exhibition was churned from cream pasteurized at temperatures ranging from 178 degrees to nearly 204 degrees Fahr., 90 per cent coming within the range of 185 and 194 degrees Fahr.

I note also that 90 per cent of the participating creameries report having cooled the cream, immediately from the pasteurizer, to temperatures ranging below 54 degrees Fahr. Hence, notwithstanding the high pasteurizing temperatures employed, no 'cooked' flavour was detected when the cream had been immediately and thoroughly cooled. In the remarks of 'defects' we find that only two packages of butter were characterized as having a 'cooked' flavour.

The temperatures at which the cream ripening commenced in 90 per cent of the cases lay between the points of 57 degrees and 64.4 degrees Fahr., and the proportion of fermentation starter added to the cream was from 4 to 8 per cent.

We find also by the printed list of awards that the score for quality ranged between 5 and 14 points (out of a possible 15), averaging 10.60. The following awards were made:—

Silver medals (24), to all butter scoring 12-1/9 points and over, 65 bronze medals to butter scoring 11-5/8 to 12 points, and 'honourable mention' to 164 exhibits scoring 8-8/9 to 11-4/9 points.

One of the experts, who afterwards delivered the lecture, giving a critical review of the quality of the exhibits as a whole, stated that 82 per cent of the butter shown was of first-class marketable quality, the remainder being seconds, with the exception of a few exhibits which were considered unsuitable for export.

It was quite interesting to note the large number of creamery men and exporters present comparing notes with catalogue of awards and butter tryer in hand, examining the butter for themselves not only to ascertain the requirements of the trade, but also to study the defects of the butters which had received the lowest scores, and remarks such as 'impure,' 'tallowy,' 'sour,' &c.

Now and then one or more of the judges were called upon to define by practical demonstration certain defects which had been noted in the awards.

In view of the opportunity which the visiting buttermakers have at all such exhibitions of a full discussion and examination, one cannot but be convinced that these form a very important feature of the Danish dairy industry. They aim at mutual instruction and improvement. They constitute to all intents and purposes a contest between the individual creameries and buttermakers, who send forward only what they consider themselves to be their very best product; and judging by the amount of interest shown by the exhibitors on this occasion, some 400 buttermakers being present, and the public generally, there can be no doubt of the educational value of these shows to all who are interested.

The provincial, as well as the local shows, are of an ambulatory nature, and are held wherever the best accommodation can be found for the exhibits, the public lectures, and for the numerous visitors.

The larger towns and cities hold out considerable inducement in the way of accommodation and money grants for the privilege of doing honour to the dairying interests of the province in which they are situated, and manufacturers of creamery machinery, equipment and supplies are always eager to secure space and make tasteful displays of some of the newest things which they consider the creamery men should see and buy.

Plate 4 shows the arrangements of the butter section at one of the large provincial exhibitions held in Odense in 1900. The machinery exhibit can be seen through the glass partition in the background.

PERMANENT OR STATE BUTTER EXHIBITIONS AT COPENHAGEN.

The 'Consecutive Series of Permanent Butter Shows' have been conducted at the Experimental Laboratory of the Royal Agricultural and Veterinary College, Copenhagen, since the year 1889.

The late Professor Fjord had, up to that time, engaged in extensive experimental and research work along the lines of dairying, which was still in its infancy, and he recognized the fact that if this branch of agriculture was to attain the importance anticipated, the co-operation of the government should be enlisted even to a greater extent than heretofore. Fjord formulated and submitted to the government and parliament a plan which he considered, if adopted, would be the means of effecting a general improvement in the quality of Danish export butter.

The plan received the cordial support of the legislative authorities and a sufficient sum of money was readily granted to enable Fjord to initiate what has since been known as the 'Consecutive Series of Butter Shows.'

The butter sent in to these exhibitions by the creameries was examined and scored by expert judges, as a commercial article, while complete chemical analyses, and to some extent bacteriological investigations, were made for the purpose of discovering the cause, or causes, of certain defects which had elicited considerable adverse criticism from the British markets.

The creameries throughout Denmark were invited to join this new movement, and to submit samples of their butter when called upon to do so. The following table indicates the number of creameries which took advantage of the invitation during each of the past eleven years. Considering that over 900 participate now, it may be fairly concluded that the information gained from this institution is being appreciated.

Year.	No. of creameries participating.	No. of packages examined.	Average percentage of water in butter.
1894.. . . .	513	1,079	13'83
1895.. . . .	593	1,374	13'70
1896.. . . .	697	1,924	13'88
1897.. . . .	683	2,016	13'79
1898.. . . .	713	2,110	13'93
1899.. . . .	740	2,035	14'06
1900.. . . .	787	2,153	14'09
1901.. . . .	808	2,376	14'06
1902.. . . .	837	2,494	14'13
1903.. . . .	877	2,592	14'25
1904.. . . .	903	2,549	14'24

The participating creameries all undertake, *i.e.*, pledge themselves, to forward a finished package of butter immediately on receipt of shipping instructions from the Experimental Laboratory, issued by mail or telegram.

The object is to have for examination representative packages of the ordinary output of butter from the creameries and, consequently, no re-working of the 'snow' butter is permitted.

It is very reasonable to suppose, and experience has proved it to be a fact, that the creameries will exercise the greatest possible care to make a uniformly fine quality of butter *all the time*, when they have to be prepared from week to week and from month to month to receive a 'surprise call' from the laboratory ordering forward immediately a package of butter to be critically examined and scored under public auspices and compared with the product from a large number of other creameries.

The exhibitors are also required to forward a signed statement with each exhibit, giving full particular regarding the manufacture of the butter forwarded. Printed forms for such statements are supplied by the laboratory to all participating creameries.

From the details giving in these statements a mass of information is available for the judges and experts connected with this work. They are given a fairly comprehensive view of the entire field, so to speak, and assist in locating defects and suggesting remedies. If the former be of a serious nature the creameries are immediately and urgently advised to secure the services of an instructor to have the matter righted.

SCALE OF 15 POINTS.

At the Danish exhibitions all butter and cheese is judged on the scale of 15 points, the latter representing a perfect sample according to the requirements of the British markets. This is the only standard used.

The 15-point scale does not necessarily correspond, relatively, with our 100-point scale. The average score awarded at most of the Danish butter shows does not generally go above 11 points, where perhaps as high as 80 per cent of the exhibits are rated first-class marketable butter. In fact any sample scoring above 10 points is considered to come within that category. Of course the aim is to reach as nearly as possible the point of perfection.

In view of the above it would, obviously, be wrong to interpret say 10 points on the Danish scale as equivalent to 66½ on our 100-point scale. Yet such comparisons are sometimes made.

METHODS OF JUDGING.

The judging of butter being a matter of a general impression formed through the sense of sight, taste and smell, the Danish authorities consider that the judgment of one individual may easily become one-sided, and to some extent misleading from time to time. As the butter shows are of a continuous character it is also considered desirable that there should be a continuity in the scores and standards from one show to another, in so far as the thing is possible.

It is considered that possible errors and divergencies in judgment can be largely overcome, or eliminated, by the adoption of the group system of judging, which now obtains at all state, provincial and local shows.

The judges officiating at the state shows are some of the most prominent butter exporters of the country, the government dairy experts and other officers of the experimental laboratory. The nine judges who are appointed to act at each show are divided into groups of three members each, and the individual groups score the butter independently of the others, thus forming a check which no doubt tends to sharpen the attention and judgment of the individuals.

The average of the three individual group scores represent the final 'character.' If any material difference occurs in the group scores of one or more exhibit, a joint re-examination is held and the final award agreed upon by the majority of the judges.

It will be seen, then, that in addition to the greater accuracy reached under the group system of scoring, the judges participating are mutually educating one another in this important work.

As already stated, the judging is done on the basis of the quality of the butter as an *export article*, and about two weeks from the time the butter was shipped from the creameries, it having been held in the meantime in the cool chambers of the laboratory at a temperature closely corresponding to that to which the butter is usually subjected in transit. The period of two weeks corresponds, also, with the time elapsing between the shipment of the butter from the creameries till it reaches the consumer in Great Britain, and this constitutes the test for keeping quality.

Some 25 exhibitions are held annually at the laboratory and a package of butter is 'called in' from each of about 100 creameries for every competition. Generally speaking, each of the participating creameries receive a 'surprise call' three times a year. Additional calls are made on creameries whose butter may be found unsatisfactory in quality. Such cases receive close attention from the laboratory.

In order that the creameries should sustain no loss financially in connection with this educational work the laboratory buys the exhibits of butter from them at current market prices. The depreciation in value is provided for by an annual government grant, made for the purpose, and amounting to something over \$10,000.

The creameries participating in each exhibition receive promptly a report of the results of the scoring and any remarks which the judges had occasion to make regarding defects, &c., accompanied by timely suggestions and advice.

At the end of each year a complete report is published and a copy supplied to all creameries interested giving the results of the year's scores, chemical analyses and such other information, and conclusions, as the compilers consider to be of value to the dairying interest as a whole.

The following table shows some interesting details regarding the water content of the butter shown during the year 1904. A total of 2,845 packages were analysed and the creameries classed as follows:—

Butter from 3·5 per cent of the creameries contained 12·13 per cent moisture.

Butter from 34·0 per cent of the creameries contained 13·14 per cent moisture.

Butter from 49·7 per cent of the creameries contained 14·15 per cent moisture.

Butter from 12'0 per cent of the creameries contained 15-16 per cent moisture.

Butter from 0'0 per cent of the creameries contained 16-16'90 per cent moisture.

Total, 100'0; average, 14'24 per cent.

IX. DAIRY SCHOOLS.

Although the subject of dairying is thought in several of the rural high schools in Denmark, there are two schools of agriculture at which regular dairy courses are conducted each year for creamery butter-makers. These courses extend over five months each.

Short term courses are also given in milk testing and bookkeeping for butter-makers, and for those who desire to qualify for the expert work in connection with the testing and record associations.

The dairy schools are conducted pretty much along the same lines as the Canadian schools, in so far as they have a staff of competent lecturers and instructors for the class-room work, as well as a working creamery and laboratory in connection therewith, where a large quantity of milk is received and handled on the most approved plan, under ordinary factory conditions.

More attention is devoted to the teaching of the science, or fundamental principles, of modern dairying than to the actual practical work in the creamery, as the students are expected to have had sufficient practical training in creameries to enable them to take up more advanced work in the dairy schools. Considerable time is devoted to instruction in, and study of, the care and feeding of live stock, the 'Heglund method' of milking, milk testing, and such other important subjects as time will permit and each case requires.

The subjects usually taught are chemistry, physics, arithmetic, grammar, botany, bacteriology, agricultural history, study of domestic animals and their care, feeding and breeding, dairy science, engineering, bookkeeping, milk testing, milking and national economy.

These subjects are taught only so far as they have a bearing on the practical work which the students will have to follow in their every day life. They are taught as thoroughly as time and circumstances will permit.

Although the dairy courses are conducted in connection with schools of agriculture, by private initiative, special government grants are available for the schools whose curricula and methods of instruction reach a required standard, and in that way they become placed, indirectly, under government supervision and approval. The examinations at the close of each term are conducted by a select committee, including one or more government commissioners.

The students who attend may, under certain conditions, apply for, and receive, financial assistance from state grants administered through county councils or the Royal Danish Agricultural Society. This assistance is calculated to defray the greater portion of the cost of taking a dairy school course or enabling the students, who have yearly engagements in creameries, to provide substitutes to take their places during their absence. In that way students of small means can fit themselves for any position as well as their more prosperous colleagues.

The dairy schools provide residence for the students taking either the full, or short, term courses, and practically all their spare time is devoted to study and gymnasium work.

X.—THE EXPERIMENTAL LABORATORY.

I think it may be safely said that one of the foremost factors in disseminating agricultural information in Denmark has been the Experimental Laboratory, affiliated with the Royal Agricultural College at Copenhagen.

It was established in 1882-3 at a cost of some \$35,000, which amount was voted by the Danish parliament on the recommendation of the late Prof. Ejord, who had at that time a number of far-reaching agricultural experiments in hand, under the auspices of the Royal Danish Agricultural Society.

Up to that time the analytical work in connection with the experiments had been done in private laboratories and become so voluminous that it was considered necessary to erect and equip a special laboratory to handle the rapidly increasing volume of work.

This institution, upon its completion, became the central station for all the experimental work carried on under public auspices in Denmark at the various ambulatory experimental stations. Experiments were conducted along the lines of dairying, live stock and bacon production.

Here the foundation was laid for the admirable system of agricultural research which Fjord knew so well how to plan and adapt to the special needs of the farmers, and the times. Fjord was, up to the time of his death in 1891, the director of experimental work and chief administrator of the considerable sums voted annually for the purpose of agricultural research. He had a large staff of able assistants, some of whom are still engaged in the work now under the direction of the Hon. Mr. F. Friis, ex-Minister of Agriculture.

Among Fjord's chief co-workers who are still identified with agricultural research work in Denmark, I may mention Professors B. Bang, V. Storch and Chief Assistant H. P. Lunde, to whom I am indebted for kind courtesy and information.

Dr. Bang is dean of the Department of Animal Physiology at the Royal Agricultural College; also director of the bacteriological division and chief veterinary adviser to the Danish government. He has been intimately identified with the struggle against the spread of bovine tuberculosis in Denmark, and enjoys an international reputation for the thorough and painstaking investigation which he has made into the nature of the disease. Through his initiative, mainly, a systematic effort is being made to gradually stamp it out, by the means of tuberculin diagnosis and a simple system of isolating the healthy animals from those in the herds showing a reaction under the tuberculin test. Good progress is being made and numerous herds throughout the country have been gradually freed from infected animals without any serious financial loss to the owners.

Dr. Bang was also mainly instrumental in having a law passed making pasteurization of milk and cream at creameries compulsory, and in this way preventing the spread of tuberculosis through the medium of the creameries.

His system, or plan, of isolating the healthy animals of infected herds is now adopted in several European countries as well as on this continent, and I understand with satisfactory results.

Dr. V. Storch is the director of the chemical division of the Experimental Laboratory, and all the analytical work in connection with the experimental work in Denmark comes under his care and supervision. Dr. Storch has made extensive investigations into the principles of cream ripening and butter-making. He was, I believe, the first scientist to make a thorough and extensive study into the bacteriology of cream ripening, and as a result of his labours in that direction the so-called 'pure cultures from cream ripening' have become an article of commerce, and are now used in nearly all creameries in Denmark.

Mr. H. P. Lunde, chief assistant to the late Prof. Fjord, and now superintendent of experimental work, was first to put into practical system the pasteurization of cream in the creameries. This process is now universally adopted by Danish creameries. Mr. Lunde has also been most energetic in his efforts to improve the quality of the cheese made in the creameries. He is much sought as a judge of dairy products and the creamery men are always glad to have the opportunity of listening to his practical lectures at the provincial and dairy shows.

On the whole, the 'Experimental Laboratory' and its staff enjoys the full confidence of the Danish farmer, and the publications issued from time to time show evidence of great care and attention to details of the experiments. Extended reviews, and sometimes criticisms, are given in the public press, and in that way the salient features and results are brought out prominently so that 'he who runs may read.'

The vote for the maintenance and work of the institution is about \$27,000 annually.



CREAMERY SECTION AT A DANISH PROVINCIAL EXHIBITION.